Dynamics of Dislocation-Particle Interactions: A Combined Modeling & Experimental Approach

Ian M. Robertson, Univ. of Illinois, Brian D. Wirth, Univ. of California-Berkeley. NSF DMR- 02- 44562

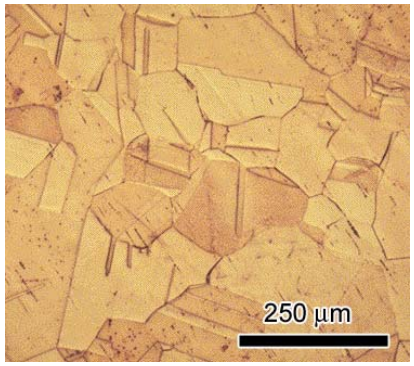
Approach: Repeated bending of copper rod to show work hardening and heat generation, followed by simple anneal to recover properties.

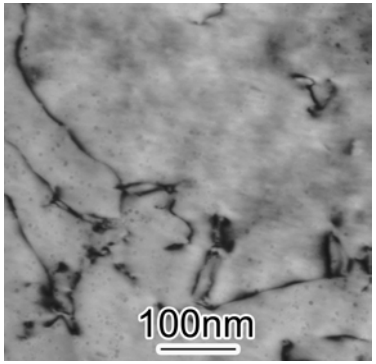
Educational Mission

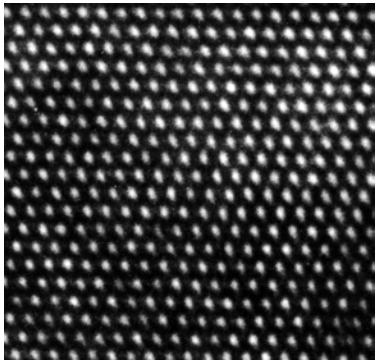
To educate graduate and undergraduate students in the complexities of material behavior (mechanical properties, in particular) as a function of scale.

Exploring your Options and Women in Engineering programs at the University of Illinois will be used to outreach to high school students and 6 through 8th grade females.

macroscale **microscale (U. Florida)**







nanoscale **atomic scale**

Understanding of structure property relations developed at different length scales.

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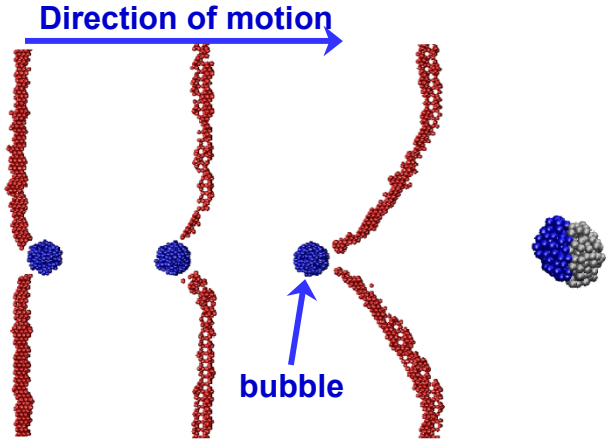
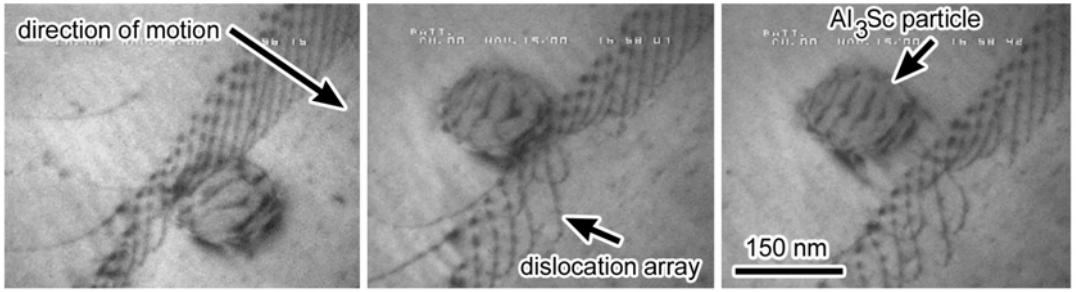
Objective: to reveal the fundamental processes controlling dislocation-precipitate interactions as a function of stress, temperature, precipitate form and interface coherency.

Approach: Combine state-of-the art *in-situ* TEM deformation characterization with multiscale materials modeling in a cross-disciplinary approach.

Outcome: New insight at the atomic and mesoscale levels of processes controlling dislocation-obstacle interactions, which can be used to develop physically-based continuum models that predict macroscale mechanical properties

In-situ TEM deformation experiments combined with atomistic modeling of dislocation-obstacle interactions





Change in interface structure suggests the dislocation array interacts with interfacial dislocations to climb over the particle.